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# PHILOSOPHICAL TRANSACTIONS.

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## XX. *On the Barometrical Variation as affected by the Moon's Declination.*

By LUKE HOWARD, *Esq.*, F.R.S.

Received January 16,—Read June 19, 1845.

THESE calculations were begun with the year 1815, and continued to 1832: the present paper continues them to 1841. The method used to bring out the averages may be thus described. Beginning as nearly as may be at the winter solstice, the days of a solar year are classed in what may be termed *weeks of declination*, mostly of seven days each, the middle day of each week corresponding,—1, with the moon's position coming north from the equator; 2, with her position in full north declination; 3, with her position returning to south over the equator; 4, with her full south declination. The average, or mean height of the barometer, in each of these classes, is presumed to express the relative power, or effect, of the position to which it belongs; when divested of the much larger amount of variation due to the effect of a northerly or southerly current, of the variable pressure of the aqueous atmosphere, of the temperature of the season, the deposition of rain, &c. Mixed with *these*, the weekly averages offer a mass of results sufficiently discordant; but the discrepancy vanishes when those under each class are *averaged upon the solar year*; the other movements now balancing and neutralising each other.

The present series of averages extends then from December 20, 1832, where the former ends, to December 23, 1841. It corresponds nearly with the latter or *cold* half of the cycle of annual temperatures, which I have already laid before the public. And it being probable that a close connexion exists between the pressure and the temperature of the atmosphere of these latitudes, in its variations, my taking these limits may facilitate to students a careful comparison of the two, throughout a cycle.

In my paper of March 1841, the mean height of the barometer for each of the four positions came out, by averages upon eighteen years ending with 1832, as follows, viz.—

|                                          |             |
|------------------------------------------|-------------|
| Moon coming north over equator . . . . . | 29·8724 in. |
| Moon in north declination . . . . .      | 29·8608 in. |
| Moon going over equator, south . . . . . | 29·8450 in. |
| Moon in south declination . . . . .      | 29·8261 in. |

Hence it was inferred that the barometrical mean is *depressed* in these latitudes by the moon's position in south declination: and that which appeared upon the aggregate of years, was found to hold also in the several nine-years' averages of which it consisted. The depression was stated to be gradual, proceeding through the three changes to the south place; but upon the planet's quitting her south position to return north, a sudden elevation of the mean, effected in a single week of declination, indicated the return of the pressure (as far as regarded *this* influence) to its former limit.

The results of the present examination differ somewhat in the proportions of pressure shown; the chief cause being, as I apprehend, the different latitude in which a part of the observations took place. In 1828, near the middle of the year, having given up my house on Tottenham-green, I removed the barometer-clock to the Villa, Ackworth, Yorkshire, in latitude  $53^{\circ} 39'$  north, and still on the east side of the island. Here I obtained for some time the yearly circle of the variation: but coming subsequently to spend the winter in the south, from my absence joined with other causes, the clock for several months in the year stood still. I had presented a good barometer to the Friends' Institution at Ackworth, where a good meteorological register is kept at my instance; and from *this* the maxima and minima, wanting in the series by the clock, have been taken.

Thus circumstanced, and the instrument standing, from the above date, on considerably higher ground, and  $2^{\circ}$  more to the north, the averages from 1824 to 1832 come out as follows, viz. moon coming north 29.8505 in.; in north declination 29.8257 in.; going south 29.8076 in.; in south declination 29.8058 in. Here we have still the depression to the place of south declination; but with a check, amounting almost to the doing of it away, in the concluding position. Let us, however, see further.

On the solar years, from 1833 to 1841, *observed wholly at Ackworth*, the averages are,—

|                                   |             |
|-----------------------------------|-------------|
| Moon coming north . . . . .       | 29.7127 in. |
| Moon in north declination . . . . | 29.6946 in. |
| Moon going south . . . . .        | 29.6969 in. |
| Moon in south declination . . . . | 29.7115 in. |

The former variation, presenting a gradual decline of gravity to the moon's south place, is here replaced by one altogether different; the loss of gravity by the north declination continues into the following week, and is restored (very nearly) in the fourth week; the moon yet full *south*. Had this discrepancy resulted from less perfect observation merely, it ought to have affected each position alike, and to have made the calculations useless; but we have here even more of *symmetry* than before. There must be something then in the more northern latitude, affecting partially the *mixed* average 1824 to 1832, and more completely the *northern* average 1833 to 1841; which is commended, with all deference, to the study and consideration of our mathematical and astronomical Fellows.

In my former paper, I exhibited likewise a set of averages *upon the whole solar year*, from 1815 to 1832, in which the *yearly mean pressure* increases to the middle of a cycle of eighteen years, and then decreases with great regularity to its former amount. I have inserted here a similar calculation, but with an opposite result; which shows the pressure decreasing from year to year, and then recovering in some measure its former level: but this, for reasons already given, comes out less regular and symmetrical than the other. I have no doubt that, when we shall have prosecuted further the comparison of the yearly mean pressures with the temperatures, there will be found a contrast between the two halves of a cycle as evident as that I have shown to exist in those of the cycle of temperature.

In the long average, 1815 to 1841, we have,—1, a half cycle *cold*; 2, a half cycle *warm*; 3, a half cycle *cold*; the result of which must needs show a preponderance of the effect of cold. But let the temperatures balance, as in the cycle 1815–32, we have then—1, coming north 29·8310 in.; 2, north 29·8260 in.; 3, going south 29·8171 in.; 4, south 29·8056 in. Again, in the balanced cycle 1824–41, we have for the four respectively,—1, coming north 29·7816 in.; 2, north 29·7601 in.; 3, going south 29·7522 in.; 4, south 29·7586 in. The results of this last average are subject in some degree to the effect of a more northerly site. Without presuming to determine even that latitude has such an effect in a space of less than three degrees, I have thought it right to place these data in the hands of the Fellows, that future students may have the opportunity (now that we have begun to distinguish between the various causes affecting the gravity of the atmosphere) of comparing (with much trouble saved) the actual differences which obtain in it, under different positions of the planet; and of analysing, with the help of the register whence they are derived, a great mass of observations tending to throw light on the nascent science of meteorology.

I have to acknowledge, in concluding this paper, my obligations to my young friend CORNELIUS HANBURY, who made for me the preliminary calculations upon the register with much care, and, I am satisfied, with the required accuracy.

L. H.

*Ackworth, October 25, 1844.*

## Barometrical Averages, &amp;c.

| Year.                                | Days. | Coming North. | North.  | Going South. | South.  | On the year. |
|--------------------------------------|-------|---------------|---------|--------------|---------|--------------|
|                                      |       | in.           | in.     | in.          | in.     | in.          |
| 1833.                                | 369   | 29.5807       | 29.6497 | 29.5333      | 29.5812 | 29.5862      |
| 1834.                                | 362   | 29.7733       | 29.6997 | 29.6653      | 29.6001 | 29.6846      |
| 1835.                                | 368   | 29.8053       | 29.8507 | 29.8631      | 29.8659 | 29.8462      |
| 1836.                                | 362   | 29.7749       | 29.4987 | 29.6004      | 29.6010 | 29.6187      |
| 1837.                                | 369   | 29.7098       | 29.7588 | 29.6514      | 29.6595 | 29.6949      |
| 1838.                                | 362   | 29.5696       | 29.7061 | 29.7283      | 29.6866 | 29.6702      |
| 1839.                                | 368   | 29.7672       | 29.7347 | 29.7626      | 29.8158 | 29.7703      |
| 1840.                                | 362   | 29.7851       | 29.7474 | 29.7724      | 29.8699 | 29.7932      |
| 1841.                                | 369   | 29.6488       | 29.6055 | 29.6957      | 29.7139 | 29.6659      |
| On nine solar years,<br>1833-1841. } |       | 29.7127       | 29.6946 | 29.6969      | 29.7115 | 29.7034      |

| Years.                                       | Coming North. | North.  | Going South. | South.  | On nine years. |
|----------------------------------------------|---------------|---------|--------------|---------|----------------|
|                                              | in.           | in.     | in.          | in.     | in.            |
| 1825-1833.                                   | 29.8063       | 29.7965 | 29.7812      | 29.7874 | 29.7928        |
| 1826-1834.                                   | 29.7719       | 29.7599 | 29.7448      | 29.7440 | 29.7552        |
| 1827-1835.                                   | 29.7403       | 29.7410 | 29.7306      | 29.7301 | 29.7355        |
| 1828-1836.                                   | 29.7223       | 29.6969 | 29.6896      | 29.6877 | 29.6991        |
| 1829-1837.                                   | 29.7057       | 29.6943 | 29.6732      | 29.6653 | 29.6846        |
| 1830-1838.                                   | 29.6930       | 29.6998 | 29.6779      | 29.6638 | 29.6836        |
| 1831-1839.                                   | 29.6960       | 29.7103 | 29.6782      | 29.6778 | 29.6906        |
| 1832-1840.                                   | 29.7126       | 29.7177 | 29.7007      | 29.7081 | 29.7098        |
| 1833-1841.                                   | 29.7127       | 29.6946 | 29.6969      | 29.7115 | 29.7039        |
| On twenty-seven solar<br>years, 1825-1841. } | 29.7290       | 29.7234 | 29.7081      | 29.7084 | 29.7172        |

| Years.     |                                                     | Coming North. | North.  | Going South.              | South.  |     |
|------------|-----------------------------------------------------|---------------|---------|---------------------------|---------|-----|
|            |                                                     | in.           | in.     | in.                       | in.     | in. |
| 1815-1823. | { On nine years,<br>the barom. at<br>Tottenham. . } | 29.8115       | 29.8263 | 29.8267                   | 29.8054 |     |
| 1824-1832. | { On nine years,<br>the barom.<br>moved 1828. }     | 29.8505       | 29.8257 | 29.8076                   | 29.8058 |     |
| 1833-1841. | { On nine years,<br>the barom. at<br>Ackworth. . }  | 29.7127       | 29.6946 | 29.6969                   | 29.7115 |     |
|            | Mean of the three                                   | 29.7916       | 29.7822 | 29.7771                   | 29.7742 |     |
|            |                                                     |               |         | Mean of the whole . . . . |         |     |
|            |                                                     |               |         | 29.7812                   |         |     |

## Barometrical Averages, &amp;c.

| Year and Periods.                         | Days. | Coming N. | Days. | North.  | Days. | Going S. | Days. | South.  |
|-------------------------------------------|-------|-----------|-------|---------|-------|----------|-------|---------|
|                                           |       | in.       |       | in.     |       | in.      |       | in.     |
| Dec. 20-26, 1832.....                     |       |           |       |         |       |          | 7     | 29·5243 |
| Dec. 27 to Jan. 22, 1833.                 | 7     | 29·7886   | 6     | 30·2941 | 7     | 29·9000  | 7     | 30·1257 |
| Jan. 23 to Feb. 18.....                   | 7     | 29·7621   | 7     | 29·1871 | 6     | 29·2008  | 7     | 29·0021 |
| Feb. 19 to March 18....                   | 7     | 29·4257   | 7     | 29·1750 | 7     | 29·9757  | 7     | 29·4300 |
| March 19 to April 14 ..                   | 7     | 29·7528   | 6     | 29·5566 | 7     | 29·3500  | 7     | 29·3143 |
| April 15 to May 12 ....                   | 7     | 29·5621   | 7     | 29·7578 | 6     | 29·4266  | 8     | 29·8443 |
| May 13 to June 8 .....                    | 6     | 29·7583   | 7     | 29·9700 | 6     | 29·9425  | 8     | 29·5206 |
| June 9 to July 5 .....                    | 7     | 29·4278   | 6     | 29·5908 | 7     | 29·4371  | 7     | 29·6064 |
| July 6 to August 1 ....                   | 7     | 29·6471   | 7     | 29·7207 | 6     | 29·5450  | 7     | 30·0657 |
| August 2-29 .....                         | 7     | 29·8978   | 7     | 29·5928 | 6     | 29·4733  | 8     | 29·6631 |
| August 30 to Sept. 25 ..                  | 7     | 29·5185   | 6     | 29·7358 | 7     | 29·5121  | 7     | 29·5678 |
| Sept. 26 to Oct. 22 ....                  | 7     | 29·7193   | 7     | 29·8985 | 6     | 29·3600  | 7     | 29·1928 |
| Oct. 23 to Nov. 18.....                   | 7     | 29·4064   | 6     | 29·5935 | 7     | 29·5966  | 7     | 29·8314 |
| Nov. 19 to Dec. 16 ....                   | 7     | 29·4021   | 7     | 29·3735 | 7     | 29·2128  | 7     | 29·4478 |
| December 17-23 .....                      | 7     | 29·0607   |       |         |       |          |       |         |
| 369 days.                                 | 97    | 29·5807   | 86    | 29·6497 | 85    | 29·5333  | 101   | 29·5812 |
|                                           |       |           |       |         |       |          |       |         |
| Dec. 24, 1833 to Jan. 12, }<br>1834 ..... |       |           | 7     | 29·3893 | 6     | 29·6225  | 7     | 29·0400 |
| January 13 to February 8.                 | 7     | 29·2743   | 7     | 29·4314 | 7     | 29·6665  | 6     | 29·7358 |
| February 9 to March 7...                  | 8     | 29·9112   | 6     | 29·7541 | 7     | 29·9107  | 6     | 29·6891 |
| March 8 to April 4 .....                  | 8     | 30·1481   | 7     | 30·1021 | 6     | 29·5241  | 7     | 29·8421 |
| April 5 to May 1 .....                    | 7     | 30·0693   | 7     | 30·0500 | 7     | 30·0064  | 6     | 29·3016 |
| May 2-28 .....                            | 8     | 29·7243   | 6     | 29·5083 | 7     | 29·6950  | 6     | 30·0875 |
| May 29 to June 25 ....                    | 8     | 29·7450   | 6     | 29·4983 | 7     | 29·4121  | 7     | 29·7314 |
| June 26 to July 22 ....                   | 7     | 29·9200   | 7     | 29·7371 | 7     | 29·6593  | 6     | 29·4933 |
| July 23 to August 19 ..                   | 8     | 29·6331   | 6     | 29·5483 | 7     | 29·6150  | 7     | 29·7386 |
| August 20 to Sept. 15 ..                  | 7     | 29·4207   | 6     | 29·4258 | 7     | 29·5286  | 7     | 29·7578 |
| Sept. 16 to Oct. 12.....                  | 7     | 29·8907   | 7     | 29·7886 | 6     | 29·8091  | 7     | 29·6936 |
| Oct. 13 to Nov. 8 .....                   | 7     | 29·3236   | 7     | 29·6564 | 7     | 29·8757  | 6     | 29·2058 |
| Nov. 9 to Dec. 6 .....                    | 7     | 29·9678   | 8     | 29·7675 | 6     | 29·3233  | 7     | 29·4850 |
| December 7-20 .....                       | 7     | 30·0243   | 7     | 30·1393 |       |          |       |         |
| 362 days.                                 | 96    | 29·7733   | 94    | 29·6997 | 87    | 29·6653  | 85    | 29·6001 |
|                                           |       |           |       |         |       |          |       |         |
| Dec. 21, 1834 to Jan. 2, }<br>1835 .....  |       |           |       |         | 7     | 30·0643  | 6     | 29·8567 |
| January 3-29.....                         | 7     | 29·9671   | 7     | 29·4850 | 7     | 29·7264  | 6     | 30·1666 |
| January 30 to February 25.                | 7     | 30·0557   | 8     | 29·9831 | 6     | 29·3791  | 6     | 29·1775 |
| February 26 to March 25.                  | 8     | 29·5162   | 7     | 29·4271 | 7     | 29·9464  | 6     | 30·3758 |
| March 26 to April 21 ..                   | 7     | 29·9807   | 7     | 30·1186 | 7     | 30·1214  | 6     | 30·2541 |
| April 22 to May 19 ....                   | 8     | 29·9812   | 7     | 29·7278 | 6     | 29·7283  | 7     | 29·7500 |
| May 20 to June 15 ....                    | 6     | 29·9008   | 8     | 29·9106 | 6     | 29·9558  | 7     | 30·2786 |
| June 16 to July 12 ....                   | 7     | 29·9078   | 7     | 29·7628 | 7     | 29·9678  | 6     | 29·7733 |
| July 13 to August 8 ....                  | 7     | 29·8571   | 8     | 30·1987 | 6     | 30·0375  | 6     | 29·9716 |
| August 9 to September 5.                  | 8     | 30·0769   | 7     | 29·8207 | 6     | 29·7808  | 7     | 30·0129 |
| September 6 to October 2.                 | 7     | 29·4550   | 7     | 29·5750 | 7     | 29·5700  | 6     | 29·1733 |
| October 3-29.....                         | 7     | 29·5417   | 7     | 29·8793 | 7     | 29·7829  | 6     | 29·5425 |
| October 30 to Nov. 26 ..                  | 7     | 30·0121   | 8     | 30·1881 | 6     | 29·8450  | 7     | 29·5571 |
| November 27 to Dec. 23.                   | 7     | 29·2164   | 7     | 29·9821 | 7     | 30·1786  | 6     | 30·2325 |
| 368 days.                                 | 93    | 29·8053   | 95    | 29·8507 | 92    | 29·8631  | 88    | 29·8659 |

## Barometrical Averages, &amp;c.

| Year and Periods.                         | Days. | Coming N. | Days. | North.  | Days. | Going S. | Days. | South.  |
|-------------------------------------------|-------|-----------|-------|---------|-------|----------|-------|---------|
|                                           |       | in.       |       | in.     |       | in.      |       |         |
| Dec. 24, 1835 to Jan. }<br>19, 1836 ..... | 7     | 30·1350   | 7     | 30·1007 | 7     | 29·4714  | 6     | 29·9450 |
| Jan. 20 to Feb. 16.....                   | 7     | 29·6457   | 7     | 29·0393 | 7     | 29·7700  | 7     | 30·0293 |
| February 17 to March 14.                  | 6     | 30·0133   | 7     | 29·0414 | 8     | 29·2000  | 6     | 28·9300 |
| March 15 to April 10 ..                   | 7     | 29·7564   | 7     | 29·0671 | 7     | 29·6335  | 6     | 29·3508 |
| April 11 to May 8.....                    | 7     | 29·7843   | 8     | 29·7244 | 6     | 29·7300  | 7     | 29·9786 |
| May 9 to June 4 .....                     | 6     | 30·1391   | 8     | 30·0775 | 7     | 30·1714  | 6     | 29·5825 |
| June 5 to July 1 .....                    | 6     | 29·5066   | 8     | 29·6937 | 7     | 29·6243  | 6     | 29·7741 |
| July 2-28 .....                           | 7     | 29·9357   | 7     | 29·5807 | 7     | 29·4935  | 6     | 29·6441 |
| July 29 to August 25 ..                   | 7     | 29·7300   | 8     | 30·0175 | 7     | 29·7607  | 6     | 29·6450 |
| August 26 to Sept. 21 ..                  | 6     | 29·7225   | 8     | 29·3287 | 7     | 29·8807  | 6     | 29·8816 |
| Sept. 22 to October 18 ..                 | 7     | 29·6143   | 7     | 29·1050 | 7     | 29·0200  | 6     | 29·7158 |
| Oct. 19 to Nov. 15 .....                  | 7     | 30·0757   | 8     | 29·6481 | 6     | 29·6116  | 7     | 29·3857 |
| Nov. 16 to Dec. 12 .....                  | 6     | 29·3076   | 8     | 29·0594 | 7     | 29·4378  | 6     | 28·9508 |
| December 13-19 .....                      | 7     | 29·4828   |       |         |       |          |       |         |
| 362 days.                                 | 93    | 29·7749   | 98    | 29·4987 | 90    | 29·6004  | 81    | 29·6010 |
|                                           |       |           |       |         |       |          |       |         |
| Dec. 20, 1836 to Jan. }<br>8, 1837 .....  | ..... | .....     | 7     | 29·8028 | 7     | 30·0964  | 6     | 29·8558 |
| Jan. 9 to Feb. 5 .....                    | 7     | 29·7293   | 8     | 29·8131 | 7     | 29·6328  | 6     | 30·0025 |
| Feb. 6 to March 4 .....                   | 7     | 29·4414   | 7     | 29·3878 | 7     | 29·4893  | 6     | 29·9933 |
| March 5-31 .....                          | 7     | 29·6178   | 7     | 29·9378 | 7     | 29·5564  | 6     | 29·5491 |
| April 1 to 28 .....                       | 7     | 29·5535   | 7     | 29·7250 | 7     | 29·4550  | 7     | 29·3750 |
| April 29 to May 25 .....                  | 7     | 29·4535   | 7     | 29·5757 | 7     | 29·8385  | 6     | 29·5741 |
| May 26 to June 21 .....                   | 7     | 29·6471   | 7     | 29·7700 | 7     | 29·4428  | 6     | 29·5775 |
| June 22 to July 19 .....                  | 7     | 29·9214   | 7     | 29·8828 | 7     | 29·8285  | 7     | 29·4764 |
| July 20 to August 15 ..                   | 7     | 29·6957   | 6     | 29·2683 | 8     | 29·9118  | 6     | 30·0016 |
| August 16 to Sept. 11 ..                  | 7     | 29·6578   | 7     | 29·8621 | 7     | 29·5843  | 6     | 29·6491 |
| Sept. 12 to October 9 ..                  | 7     | 29·5714   | 7     | 30·1271 | 7     | 30·0593  | 7     | 30·0228 |
| October 10 to Nov. 5 ..                   | 7     | 30·1714   | 6     | 29·9350 | 7     | 29·1971  | 7     | 29·0793 |
| November 6 to Dec. 2 ..                   | 7     | 29·7257   | 7     | 29·5578 | 7     | 29·3657  | 6     | 29·4166 |
| December 3-23 .....                       | 7     | 30·0418   | 6     | 29·9775 | 8     | 29·6618  |       |         |
| 369 days.                                 | 91    | 29·7098   | 96    | 29·7588 | 100   | 29·6514  | 82    | 29·6595 |
|                                           |       |           |       |         |       |          |       |         |
| Dec. 24-30, 1837 .....                    | ..... | .....     | ..... | .....   | ..... | .....    | 7     | 29·7128 |
| Dec. 31 to Jan. 26, 1838..                | 6     | 29·8166   | 7     | 30·2093 | 8     | 29·9450  | 6     | 29·6275 |
| Jan. 27 to Feb. 22 .....                  | 7     | 29·7735   | 7     | 29·6257 | 7     | 29·5421  | 6     | 29·7900 |
| Feb. 23 to March 22 .....                 | 7     | 29·0107   | 6     | 29·4400 | 8     | 29·9170  | 7     | 29·3164 |
| March 23 to April 18 ..                   | 6     | 29·9400   | 7     | 30·0471 | 7     | 29·6014  | 7     | 29·7335 |
| April 19 to May 15 .....                  | 7     | 29·5357   | 6     | 29·6825 | 8     | 30·0125  | 6     | 29·5541 |
| May 16 to June 11 .....                   | 7     | 29·3178   | 6     | 29·5433 | 8     | 29·4331  | 6     | 29·5325 |
| June 12 to July 9 .....                   | 7     | 29·4364   | 7     | 29·4621 | 7     | 29·5914  | 7     | 29·6164 |
| July 10 to August 5 .....                 | 7     | 29·4643   | 6     | 29·6758 | 7     | 29·6593  | 7     | 29·5485 |
| August 6 to Sept. 1 .....                 | 7     | 29·7471   | 7     | 29·9114 | 7     | 29·4707  | 6     | 29·9083 |
| September 2-29 .....                      | 7     | 29·5743   | 7     | 30·1450 | 7     | 29·8107  | 7     | 29·8071 |
| Sept. 30 to October 26 ..                 | 6     | 30·3225   | 7     | 29·9721 | 7     | 29·4271  | 7     | 29·7535 |
| October 27 to Nov. 22 ..                  | 7     | 29·2678   | 6     | 29·1391 | 7     | 29·8557  | 7     | 29·5221 |
| November 23 to Dec. 20..                  | 7     | 29·1985   | 6     | 29·3266 | 8     | 30·2018  | 7     | 30·1907 |
| 362 days.                                 | 88    | 29·5696   | 85    | 29·7061 | 96    | 29·7283  | 93    | 29·6866 |

## Barometrical Averages, &amp;c.

| Year and Periods.                        | Days. | Coming N.<br>in. | Days. | North.<br>in. | Days. | Going S.<br>in. | Days. | South.<br>in. |
|------------------------------------------|-------|------------------|-------|---------------|-------|-----------------|-------|---------------|
| Dec. 21, 1838 to Jan. }<br>16, 1839..... | 7     | 29·6593          | 6     | 30·0075       | 7     | 29·3828         | 7     | 29·8335       |
| Jan. 17 to Feb. 12 .....                 | 6     | 29·7066          | 7     | 30·0500       | 7     | 29·7338         | 7     | 30·1707       |
| Feb. 13 to March 12....                  | 7     | 29·5764          | 7     | 29·7157       | 7     | 30·0678         | 7     | 29·9528       |
| March 13 to April 8....                  | 6     | 29·6983          | 7     | 29·5778       | 7     | 29·5364         | 7     | 30·1393       |
| April 9 to May 6 .....                   | 7     | 30·3028          | 6     | 29·6591       | 7     | 30·0828         | 8     | 29·8706       |
| May 7 to June 2 .....                    | 6     | 30·0133          | 7     | 29·7085       | 6     | 30·0375         | 8     | 30·0875       |
| June 3-29 .....                          | 6     | 29·7108          | 7     | 29·9914       | 7     | 29·7457         | 7     | 29·6343       |
| June 30 to July 26 .....                 | 6     | 30·0841          | 7     | 29·5835       | 7     | 29·6671         | 7     | 29·6221       |
| July 27 to August 22 ..                  | 7     | 29·6443          | 6     | 29·9141       | 7     | 29·8235         | 7     | 29·9007       |
| August 23 to Sept. 19 ..                 | 7     | 29·7293          | 7     | 29·2593       | 7     | 29·6635         | 7     | 29·1814       |
| Sept. 20 to October 16 ..                | 6     | 29·5291          | 7     | 29·6064       | 7     | 29·8650         | 7     | 29·7078       |
| October 17 to Nov. 13 ..                 | 7     | 29·9271          | 6     | 30·3333       | 7     | 29·8193         | 8     | 29·5800       |
| Nov. 14 to Dec. 10 .....                 | 6     | 29·7666          | 6     | 29·7033       | 8     | 29·4881         | 7     | 29·9250       |
| December 11-23 .....                     | 7     | 29·3928          | 6     | 29·1758       |       |                 |       |               |
| 368 days.                                | 91    | 29·7672          | 92    | 29·7347       | 91    | 29·7626         | 94    | 29·8158       |
|                                          |       |                  |       |               |       |                 |       |               |
| Dec. 24, 1839 to Jan. 6, }<br>1840.....  | ..    | .....            | ..    | .....         | 7     | 29·6443         | 7     | 29·8007       |
| Jan. 7 to Feb. 2.....                    | 7     | 30·1457          | 6     | 29·5441       | 7     | 29·1057         | 7     | 29·3843       |
| Feb. 3 to March 1.....                   | 7     | 29·2600          | 6     | 29·6741       | 7     | 30·2893         | 8     | 30·4575       |
| March 2-28 .....                         | 6     | 30·5041          | 6     | 30·3100       | 8     | 30·1956         | 7     | 30·1607       |
| March 29 to April 24 ..                  | 7     | 29·8300          | 6     | 29·9783       | 7     | 30·0000         | 7     | 30·1857       |
| April 25 to May 22 .....                 | 7     | 30·2485          | 6     | 29·9866       | 7     | 29·5728         | 8     | 29·8018       |
| May 23 to June 18 .....                  | 7     | 29·8378          | 6     | 29·9566       | 6     | 29·8183         | 8     | 29·6793       |
| June 19 to July 15 .....                 | 7     | 29·7450          | 6     | 29·8216       | 7     | 29·4428         | 7     | 29·9164       |
| July 16 to August 11 ..                  | 7     | 29·5493          | 6     | 29·7825       | 7     | 30·0328         | 7     | 29·8500       |
| August 12 to Sept. 8....                 | 7     | 29·3700          | 7     | 29·7614       | 6     | 29·9975         | 8     | 29·7575       |
| Sept. 9 to October 5....                 | 6     | 29·5616          | 7     | 29·5057       | 7     | 29·5185         | 7     | 29·9457       |
| October 6 to Nov. 1 .....                | 7     | 30·2550          | 6     | 29·8550       | 7     | 29·7407         | 7     | 29·2628       |
| November 2-29 .....                      | 7     | 28·8143          | 6     | 29·7575       | 7     | 29·4371         | 8     | 30·1068       |
| Nov. 30 to Dec. 19.....                  | 7     | 30·0857          | 6     | 29·7833       | 7     | 30·0185         |       |               |
| 362 days.                                | 89    | 29·7851          | 80    | 29·7474       | 97    | 29·7724         | 96    | 29·8699       |
|                                          |       |                  |       |               |       |                 |       |               |
| Dec. 20-26, 1840 .....                   | ..    | .....            | ..    | .....         | ..    | .....           | 7     | 30·2678       |
| Dec. 27, 1840 to Jan. }<br>22, 1841..... | 7     | 30·0185          | 6     | 29·4708       | 7     | 29·3257         | 7     | 29·8750       |
| January 23 to Feb. 18 ..                 |       | 30·0085          | 6     | 30·1100       | 7     | 29·7057         | 7     | 29·3535       |
| February 19 to March 18.                 | 7     | 30·0443          | 6     | 29·5758       | 6     | 30·0541         | 8     | 29·8550       |
| March 19 to April 14 ..                  | 7     | 29·5207          | 6     | 29·5158       | 7     | 29·4850         | 7     | 29·7793       |
| April 15 to May 11 .....                 | 7     | 29·7350          | 6     | 29·6400       | 7     | 29·7907         | 7     | 29·6650       |
| May 12 to June 8 .....                   | 7     | 29·7293          | 7     | 29·7757       | 6     | 29·9175         | 8     | 30·0050       |
| June 9 to July 5 .....                   | 7     | 29·8428          | 6     | 29·6700       | 7     | 29·6671         | 7     | 29·8614       |
| July 6 to August 1 .....                 | 7     | 29·5471          | 6     | 29·6833       | 7     | 29·7371         | 7     | 29·6093       |
| August 2-28 .....                        | 7     | 29·5057          | 7     | 29·5414       | 6     | 29·8050         | 7     | 29·9543       |
| August 29 to Sept. 25 ..                 | 8     | 29·6656          | 6     | 29·7008       | 7     | 29·7850         | 7     | 29·6114       |
| Sept. 26 to Oct. 22 .....                | 7     | 29·2443          | 6     | 29·0675       | 7     | 29·4378         | 7     | 29·5014       |
| October 23 to Nov. 18 ..                 | 7     | 29·3571          | 7     | 30·0778       | 6     | 29·9675         | 7     | 29·2857       |
| Nov. 19 to Dec. 15 .....                 | 8     | 29·4881          | 6     | 29·0433       | 7     | 29·3657         | 6     | 29·3708       |
| December 16-23 .....                     | 8     | 29·3762          |       |               |       |                 |       |               |
| 369 days.                                | 102   | 29·6488          | 81    | 29·6055       | 87    | 29·6957         | 99    | 29·7139       |